

1                   1.     A process for permanently attaching an overlay having an outboard  
2     and inboard surface to an outboard surface of a wheel, said wheel and said overlay each  
3     having at least one predefined opening therein, said process comprising the steps of:

4                   locating said overlay on a fixture with said outboard surface facing  
5     downward;

6                   positioning said wheel with said outboard surface facing downward  
7     against said inboard surface of said overlay defining a wheel/overlay assembly;

8                   heating said wheel/overlay assembly to a predetermined  
9     temperature;

10                  placing said wheel/overlay assembly between an upper and lower  
11     platen of a foam filling station having a plurality of locating nests selectively positioned  
12     thereon;

13                  engaging at least one of said plurality of locating nests with said  
14     outboard surface of said wheel/overlay assembly so as to close one of said at least one  
15     predefined openings of said overlay and said wheel to create a mold cavity between said  
16     wheel and said overlay;

17                  beginning injecting a predefined quantity of a foamable liquid into  
18     said mold cavity;

19                  completing injection of said predefined quantity of said foamable  
20     liquid while continuing to engage said at least one of said plurality of locating nests with  
21     said at least one predefined opening in each said overlay and said wheel;

22                  holding said mold cavity closed for a predetermined time to allow  
23     said foamable liquid to completely fill said mold cavity; and

disengaging said one of said plurality of locating nests and removing said wheel/overlay assembly from said foam filling station.

2. The process as claimed in claim 1 wherein said step of heating said wheel/overlay assembly further comprises heating said wheel/overlay assembly to a predetermined temperature within the range of 90°F to 190°F before said step of injecting said predefined quantity of foamable liquid.

3. The process as claimed in claim 2 wherein said step of heating said wheel/overlay assembly further comprises heating said wheel/overlay assembly to a temperature within the range of 120°F to 140°F.

4. The process as claimed in claim 1 further comprising the step of applying an adhesive sealant to one of said inboard surface of said overlay and said outboard surface of said wheel before said step of positioning said wheel onto said overlay.

5. The process as claimed in claim 1 further comprising the steps of:  
applying a vacuum to said overlay to remove any warpage of said overlay; and

applying an adhesive sealant to said inboard surface of said overlay and said outboard surface of said wheel before said step of positioning said wheel onto said overlay.

6. The process as claimed in claim 4 wherein said step of applying an adhesive sealant to one of said inboard and said outboard surface of said overlay further comprises robotic application of said adhesive sealant.

7. The process as claimed in claim 1 further comprising the steps of:

applying a vacuum to said mold cavity before said step of injecting said predefined quantity of foamable liquid; and

maintaining said vacuum during said steps of injecting said predefined quantity of foamable liquid and holding said mold cavity closed for a predetermined period of time.

8. The process as claimed in claim 1 further comprising the step of:  
selectively engaging at least one additional nest of said plurality of  
locating nests with said other of said at least one predefined opening between said overlay  
and said wheel so as to complete close said mold cavity.

9. A process for permanently attaching an overlay having an outboard surface, an inboard surface, an outer diameter, an inner diameter, a valve stem opening, at least one turbine opening, and a flange area about the outer diameter, to a wheel having an outboard surface, an outer diameter with a wheel rim flange, a valve stem opening, at least one turbine opening, a hub bore, and a bolt pattern, said process comprising the steps of:

locating said overlay in a fixture with its inboard surface exposed and its outboard surface facing downward;

applying a sealant to a predetermined area of said inboard surface of  
said overlay:

locating said wheel;

placing said wheel in said fixture with its outboard surface facing said inboard surface of said overlay to define an overlay/wheel assembly having a cavity therebetween;

14 conditioning said overlay/wheel assembly to completely cure said

15 sealant;

16 heating said overlay/wheel assembly to a predefined temperature

17 within the range of 90°F to 190°F;

18 clamping said overlay/wheel assembly to a pallet and placing said  
19 pallet at an angle with the horizontal in a filling station;

20 engaging a first set of nests with said overlay/wheel assembly, said  
21 first set of nests comprising a bottom nest, a valve stem nest, and at least one turbine  
22 opening nest, said bottom nest generally conforming to said outboard surface of said  
23 overlay;

24 injecting liquid foam into said cavity;

25 selectively engaging a second set of nests with said overlay/wheel  
26 assembly, said second set of nests comprising at least one turbine opening nest and a center  
27 bottom nest generally conforming to said inner diameter of said overlay and said bolt  
28 pattern of said wheel wherein said center nest bottom creates a seal by means of expanding  
29 radially when compressed in an axial direction against said wheel;

30 whereby said second set of nests are selectively engaged as said  
31 liquid foam expands within said cavity to fill said cavity such that after all of said nests are  
32 engaged said foam completely fills said cavity.

33 disengaging said second set of nests from said overlay/wheel  
34 assembly after a predetermined time;

disengaging said first set of nests from said overlay/wheel assembly;

and

maintaining light clamping pressure on said overlay/wheel assembly

until said foam completely cures.

10. The process as claimed in claim 9 further comprising the step of applying a vacuum to said overlay before said step of applying a sealant to said overlay.

11. The process as claimed in claim 9 wherein said step of locating said overlay further comprises:

radially locating said outer diameter of said overlay;

circumferentially locating said overlay off of said valve stem

opening of said overlay; and

axially locating said overlay off of said wheel rim flange of said  
d overlay.

12. The process as claimed in claim 11 wherein said step of radially locating said overlay further comprises locating said overlay off of said inner diameter of said overlay.

13. The process as claimed in claim 11 wherein said step of circumferentially locating said overlay further comprises locating said overlay off of said at least one turbine opening of said overlay.

14. The process as claimed in claim 9 wherein said step of applying said sealant further comprises robotically applying said sealant.

1                   15. The process as claimed in claim 9 wherein said step of applying said  
2 sealant further comprises applying a sealant from the group consisting of silicone,  
3 urethane, epoxy, and acrylic.

1                   16. The process as claimed in claim 9 wherein said step of locating said  
2 wheel further comprises:

3                   axially locating said wheel off of said wheel rim flange;  
4                   radially locating said wheel off of said wheel rim flange; and  
5                   circumferentially locating said wheel off of said valve stem opening.

1                   17. The process as claimed in claim 16 wherein said step of  
2 circumferentially locating said wheel further comprises locating said wheel off of said at  
3 least one turbine opening.

1                   18. The process as claimed in claim 9 further comprising the step of  
2 placing said overlay/wheel assembly on a palletized line wherein an individualized pallet  
3 can be moved independently through a series of operations before said step of preheating  
4 said overlay/wheel assembly.

1                   19. The process as claimed in claim 18 wherein said step of placing said  
2 overlay/wheel assembly on a palletized line further comprises placing said overlay/wheel  
3 assembly on an individual pallet having independent clamping means to hold said overlay  
4 on said wheel so as to maintain light clamping pressure until said liquid foam cures.

1                   20. The process as claimed in claim 9 wherein said step of engaging said  
2 first set of nests further comprises engaging a bottom nest manufactured by pour-in-place  
3 techniques of a material chosen from the group consisting of high durometer silicone,  
4 epoxy, and urethane.

1                   21. The process as claimed in claim 9 wherein said step of engaging said  
2 first set of nests further comprises engaging a bottom nest manufactured by casting a  
3 material chosen from the group consisting of aluminum, steel, and kirksite.

1                   22. The process as claimed in claim 9 wherein said step of engaging said  
2 first set of nests further comprises engaging a bottom nest manufactured by milling a  
3 material chosen from the group consisting of aluminum and steel.

1                   23. The process as claimed in claim 9 wherein said step of engaging said  
2 first set of nests further comprises engaging a valve stem nest and at least one turbine  
3 opening nest independently, allowing independent movement for locating said overlay to  
4 said wheel.

5                   24. The process as claimed in claim 9 wherein said step of clamping  
6                   said overlay/wheel assembly to a pallet further comprises:

7                   clamping said overlay/wheel assembly to said pallet by a clamping  
8                   system having an upper stationary platen and a lower moving platen below said upper  
9                   stationary platen; and

10                  raising said lower moving platen towards said upper stationary  
11                  platen whereby said overlay/wheel assembly is held between said upper and lower platens.

12                  25. The process as claimed in claim 19 wherein said step of placing said  
13                  overlay/wheel assembly on an individual pallet having independent clamping means  
14                  further comprises placing said overlay/wheel assembly on an individual pallet having  
15                  independent clamping means comprised of a plurality of mechanical toggles that sandwich  
16                  said overlay/wheel assembly to said individual pallet and said bottom nest.

26. An apparatus for permanently attaching an overlay having an outboard surface, an inboard surface, an outer diameter, an inner diameter, a valve stem opening, at least one turbine opening, and a flange area about the outer diameter, to a wheel having an outboard surface on a wheel disc, an outer wheel flange, a rim flange, a valve stem opening, a fill port, at least one turbine opening, a hub bore, and a bolt pattern, said apparatus comprising:

a fixture for locating said wheel;

first means for clamping said wheel to said overlay, said clamping means being attached to said fixture and locating said overlay to said wheel, said outboard surface of said wheel and said inboard surface of said overlay defining a cavity therebetween;

a first set of nests aligned with and contacting said overlay and said wheel, said first set of nests having a bottom nest, a valve stem nest adjacent said bottom nest and at least one turbine opening nest aligned with said at least one turbine opening, said bottom nest generally conforming to said outboard surface of said overlay, said valve stem nest and said at least one turbine opening nest closing off said valve stem opening and said at least one turbine opening;

a second set of nests comprising a center bottom nest generally conforming to said inner diameter of said overlay and said bolt pattern of said wheel wherein said second set of nests create a seal by means of expanding radially when compressed in an axial direction against said wheel;

a movable pallet positioned under said fixture for locating said overlay to said wheel;

first means for clamping said overlay and said wheel to said movable pallet;

second means for clamping disposed around said wheel and said movable pallet, said second means for clamping comprising:

an upper stationary platen having a fill port, said upper stationary platen contacting a surface of said wheel disc; and

a lower moving platen contacting said movable pallet

wherein said wheel, said overlay and said movable pallet are clamped between said upper stationary and said lower moving platens of said second means for clamping; and

a foam filling station for filling said cavity with a foam material, said foam filling station having a nozzle mounted to said upper stationary platen of said second means for clamping, said nozzle being in communication with said fill port of said wheel.

27. A process for permanently attaching an overlay having an outboard surface and an inboard surface to a wheel having an outer surface and at least one predefined opening therein, said process comprising the steps of:

locating said overlay in a fixture;  
positioning said wheel on said inboard surface of said overlay  
defining a cavity between said outer surface of said wheel and said inboard surface of said overlay, said overlay having at least one predefined opening therein, said at least one predefined opening of said wheel peripherally surrounding said at least one predefined opening of said overlay;

clamping said overlay and wheel to a pallet;  
heating said overlay and said wheel to a predetermined temperature;  
engaging at least one localized nest in said at least one predefined opening of said overlay and said at least one predefined opening of said wheel so as to create a localized area of said cavity between said inboard surface of said overlay and said outer surface of said wheel, whereby a mold is made of said cavity;  
injecting a foamable liquid in to said cavity;  
curing said foamable liquid;  
disengaging said localized nest; and  
unclamping said wheel and said overlay from said pallet.

28. The process as claimed in claim 27 further comprising the step of clamping said wheel to said overlay after positioning said wheel on said overlay, said clamping steps defining a cavity between said overlay and said wheel, said cavity having a plurality of openings.

29. The process as claimed in claim 27 wherein said step of heating said overlay and said wheel further comprises heating said overlay and wheel to a predetermined temperature within the range of 90°F to 190°F before said step of injecting said predefined quantity of foamable liquid.

30. The process as claimed in claim 27 further comprising the step of applying an adhesive sealant to said inboard surface of said overlay before said step of positioning said wheel on said inboard surface of said overlay.

31. The process as claimed in claim 27 further comprising the steps of:

applying a vacuum to said overlay to remove any warpage of said overlay; and

applying an adhesive sealant to said inboard surface of said overlay before said step of positioning said wheel on said inboard surface of said overlay.

32. The process as claimed in claim 27 further comprising the steps of:

applying a vacuum to said mold cavity before said step of injecting said foamable liquid; and

creating a vacuum in said mold cavity during said steps of injecting said predefined quantity of foamable liquid and holding said mold cavity closed for a predetermined period of time.